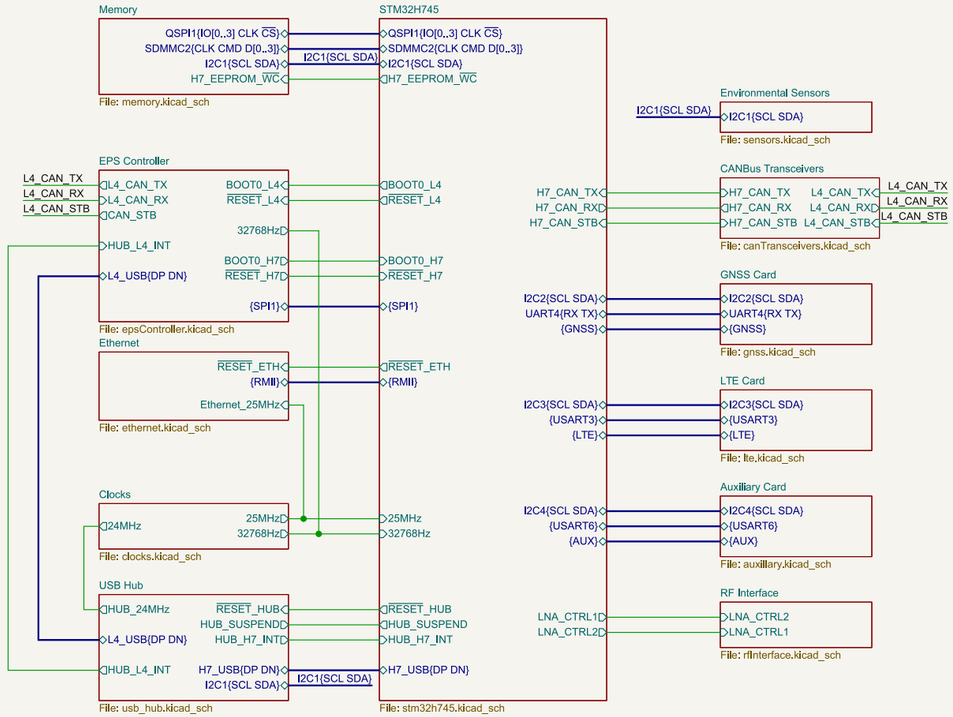
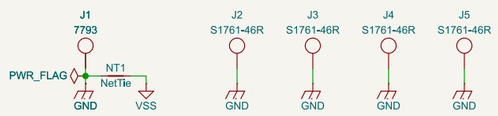




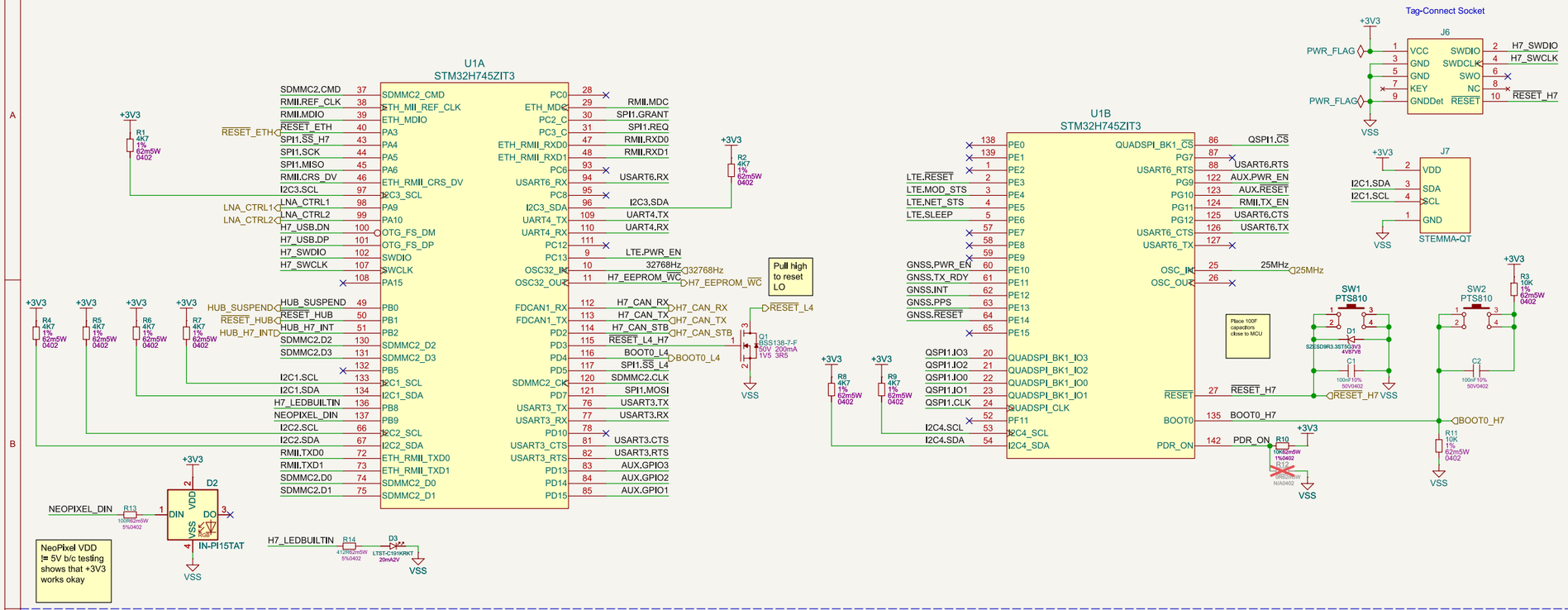
Status PROTOTYPE

Embry-Riddle Aeronautical University

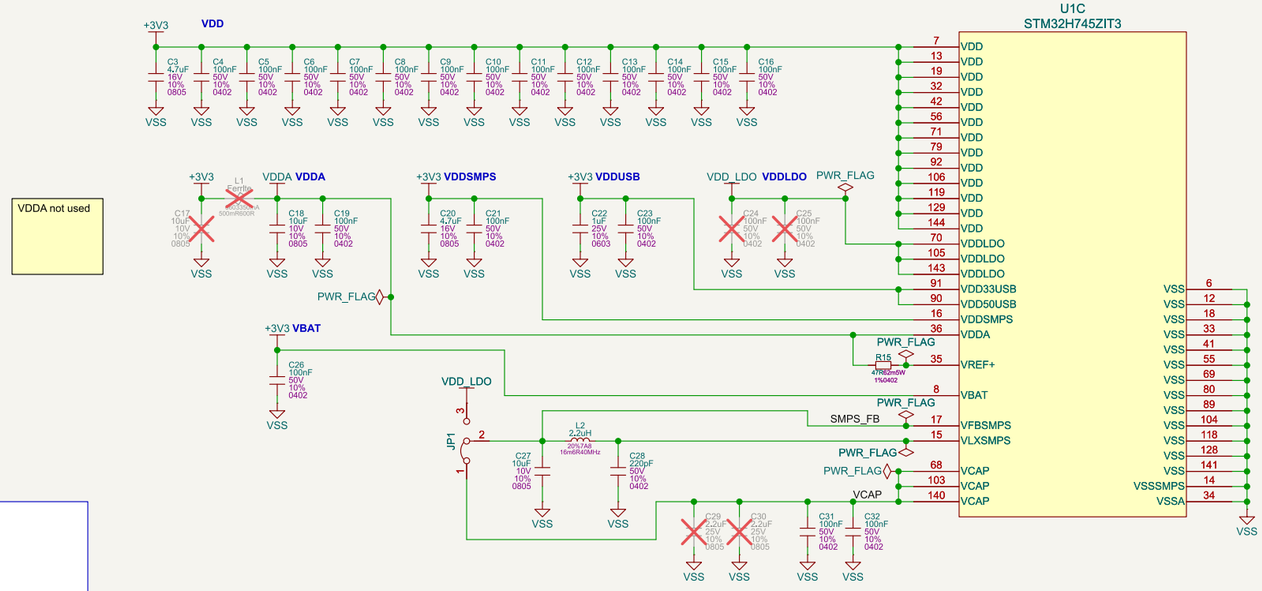
Title: Awohali - System Diagram

Size	Sheet: /	Revision: 1
B		
Date: 2025-05-17		Sheet 1 of 16
File: mainBoard.kicad_sch		Drawn By: Madison Gleydura

STM32H745 GPIO



STM32H745 Power Supplies



Net Busses

Ethernet (TCP/IP)

RMII.TX_EN, RMII.TXD0, RMII.TXD1, RMII.RXD0, RMII.RXD1, RMII.CRS_DV, RMII.MDC, RMII.MDIO, RMII.REF_CLK → {RMII}

SD Connector

SDMMC2.CLK, SDMMC2.CMD, SDMMC2.D0, SDMMC2.D1, SDMMC2.D2, SDMMC2.D3 → SDMMC2{CLK CMD D[0..3]}

QSPI Flash

QSPI1.IO0, QSPI1.IO1, QSPI1.IO2, QSPI1.IO3, QSPI1.CLK, QSPI1.CS → QSPI1{IO[0..3] CLK CS}

SPI1.MOSI, SPI1.MISO, SPI1.SCK, SPI1.SS_L4, SPI1.SS_H7, SPI1.GRANT, SPI1.REQ → {SPI1}

Upstream USB FS

H7_USB.DP, H7_USB.DN → H7_USB{DP DN}

M.2 GPIO

GNSS.RESET, GNSS.PPS, GNSS.INT, GNSS.TX_RDY, GNSS.PWR_EN → {GNSS}

LTE.RESET, LTE.SLEEP, LTE.NET_STS, LTE.MOD_STS, LTE.PWR_EN → {LTE}

AUX.RESET, AUX.GPIO1, AUX.GPIO2, AUX.GPIO3, AUX.PWR_EN → {AUX}

I2C Busses

I2C1.SCL, I2C1.SDA → I2C1{SCL SDA}

I2C2.SCL, I2C2.SDA → I2C2{SCL SDA}

I2C3.SCL, I2C3.SDA → I2C3{SCL SDA}

I2C4.SCL, I2C4.SDA → I2C4{SCL SDA}

UART/USART Busses

USART3.TX, USART3.RX, USART3.CTS, USART3.RTS → {USART3}

UART4.RX, UART4.TX → UART4{RX TX}

USART6.TX, USART6.RX, USART6.CTS, USART6.RTS → {USART6}

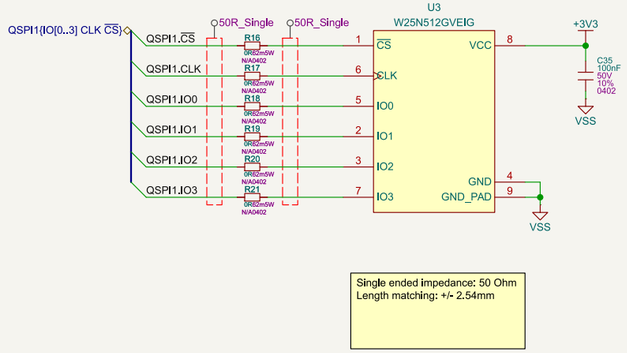
Status PROTOTYPE

Embry-Riddle Aeronautical University

Title: Awohali - STM32H745

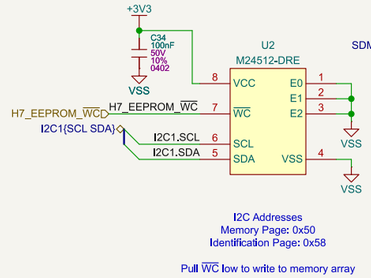
Size	Sheet	Revision
B	Sheet: /STM32H745/	Revision: 1
Date: 2025-05-13		Sheet 2 of 16
File: stm32h745.kicad_sch		Drawn By: Madison Gleydura

128Mb QSPI NOR Flash



Single ended impedance: 50 Ohm
Length matching: +/- 2.54mm

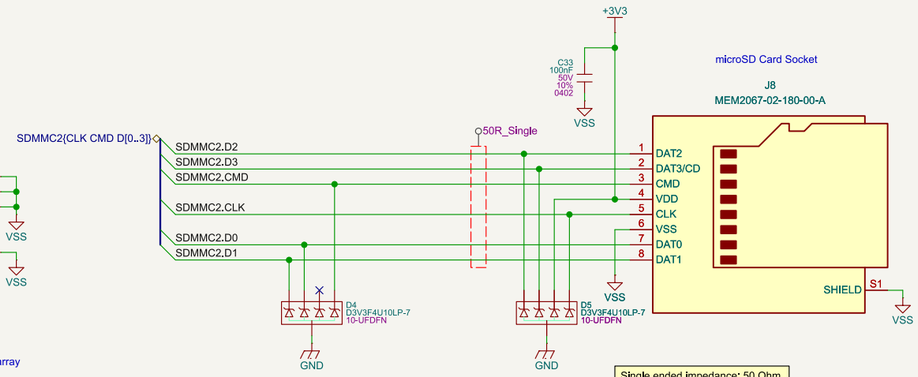
512kB I2C EEPROM



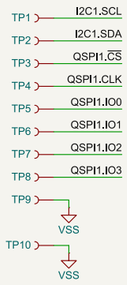
I2C Addresses
Memory Page: 0x50
Identification Page: 0x58

Pull $\overline{WC}$ low to write to memory array

microSD Card Socket



Single ended impedance: 50 Ohm
Length matching: +/- 2.54mm



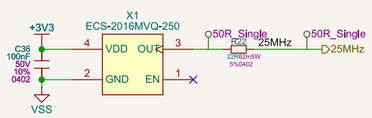
Status PROTOTYPE

Embry-Riddle Aeronautical University

Title: Awohali - Memory

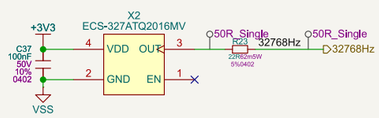
Size	Sheet: /Memory/	Revision: 1
B		
Date: 2025-05-13		Sheet 3 of 16
File: memory.kicad_sch		Drawn By: Madison Gleydura

STM32H7 / Ethernet 25MHz Clock



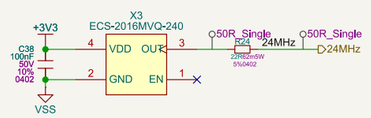
*Note: Need to calculate better Rs for clocks

STM32H7 / STM32L4 32.768kHz Clock



Single ended impedance: 50 Ohm

USB Hub 24MHz Clock



Status PROTOTYPE

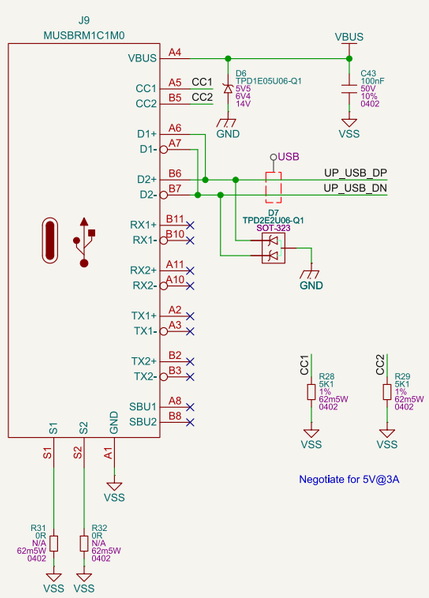
Embry-Riddle Aeronautical University

Title: Awohali - Clocks

Size	Sheet: /Clocks/	Revision: 1
B		
Date: 2025-05-13		Sheet 4 of 16
File: clocks.kicad_sch		Drawn By: Madison Gleydura

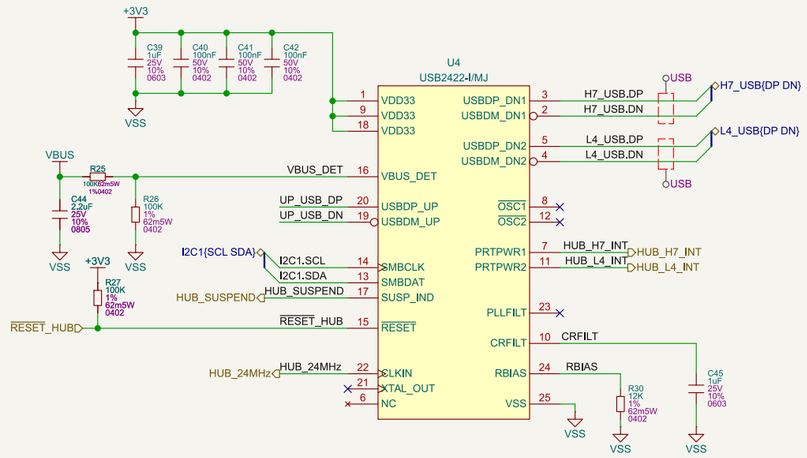
Upstream Facing USB Port

VIN: 5V@3A



Differential impedance: 90 Ohm
Length matching: +/- 15.24mm for DP/DN

USB Hub



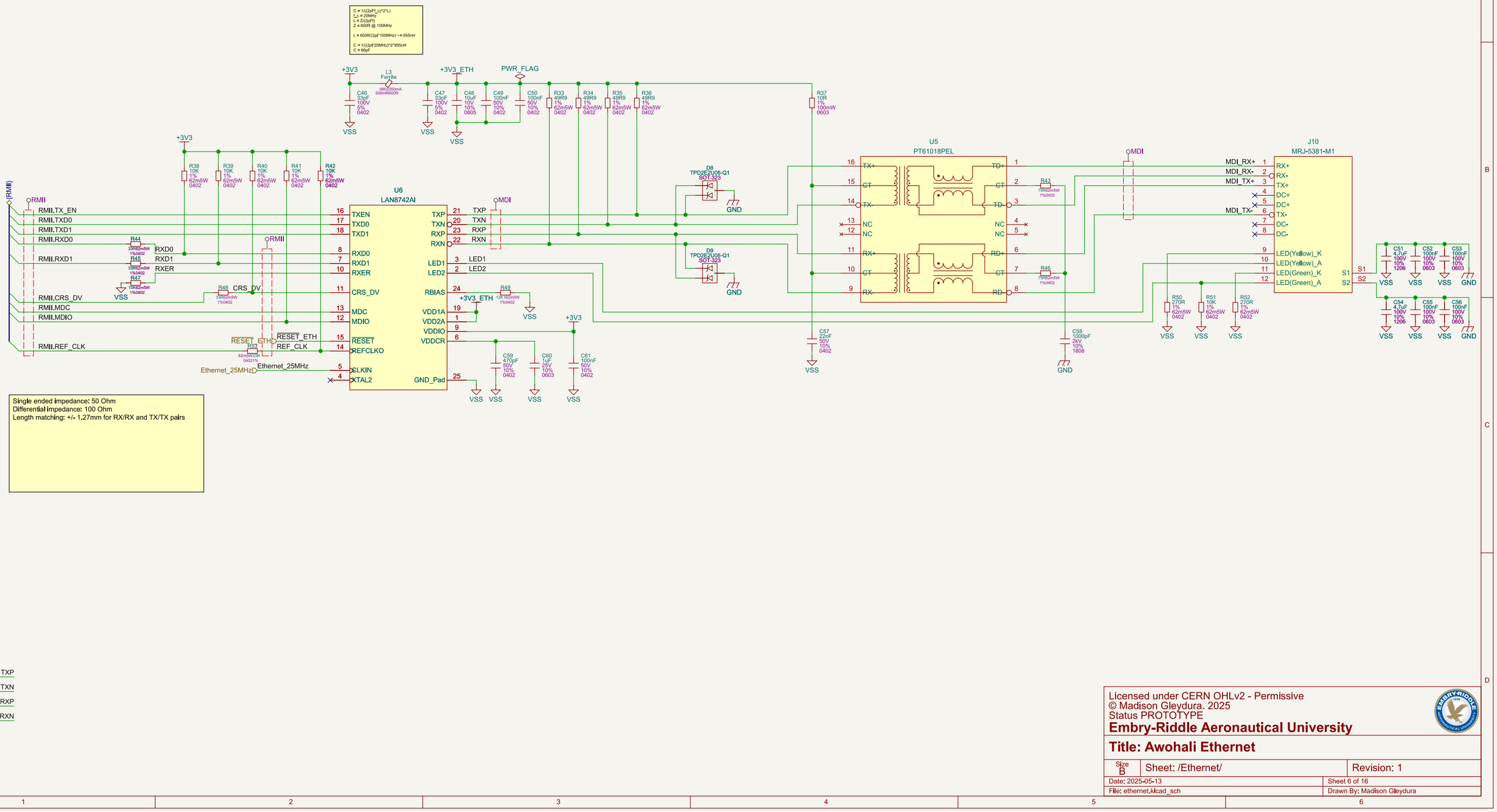
TP11 H7_USB.DP
TP12 H7_USB.DN
TP13 L4_USB.DP
TP14 L4_USB.DN

Status PROTOTYPE

Embry-Riddle Aeronautical University

Title: Awohali USB Hub

Size	Sheet: /USB Hub/	Revision: 1
B		
Date: 2025-05-13		Sheet 5 of 16
File: usb_hub.kicad_sch		Drawn By: Madison Gleydura



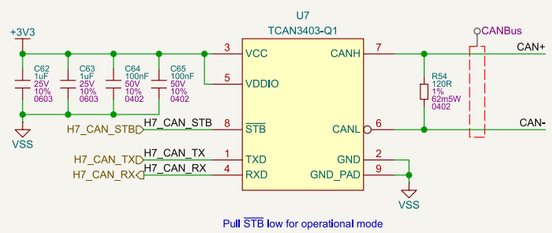
Status PROTOTYPE

Embry-Riddle Aeronautical University

Title: Awohali Ethernet

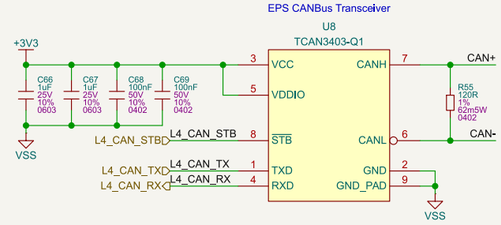
Size	Sheet: /Ethernet/	Revision: 1
B		
Date: 2025-05-13		Sheet 6 of 16
File: ethernet.kicad_sch		Drawn By: Madison Gleydura

Host CANBus Transceiver



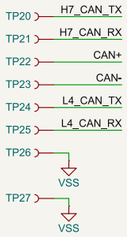
Pull $\overline{STB}$ low for operational mode

EPS CANBus Transceiver



Pull $\overline{STB}$ low for operational mode

Differential Impedance: 120 Ohm
Length matching: +/- 10mm for CANH/CANL

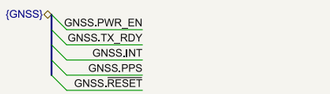


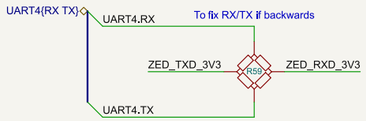
Status PROTOTYPE

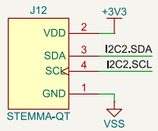
Embry-Riddle Aeronautical University

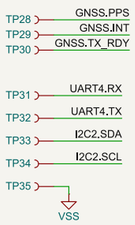
Title: Awohali CANBus Transceivers

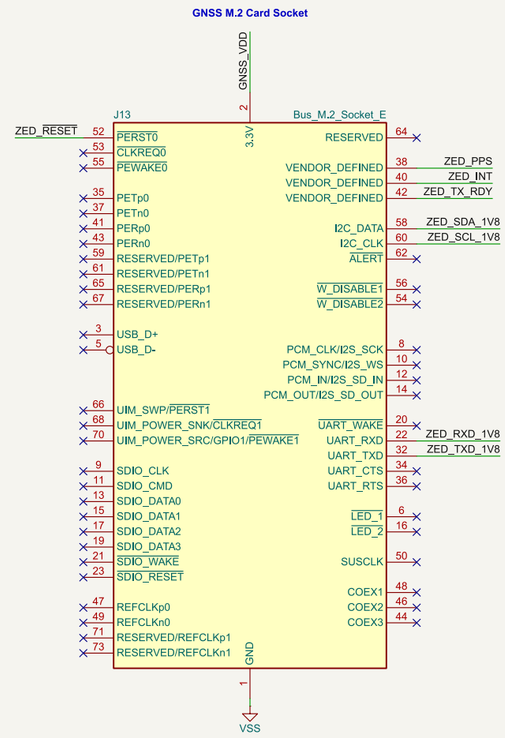
Size	Sheet	Revision
B	Sheet: /CANBus Transceivers/	Revision: 1
Date: 2025-05-13		Sheet 7 of 16
File: canTransceivers.kicad_sch		Drawn By: Madison Gleydura

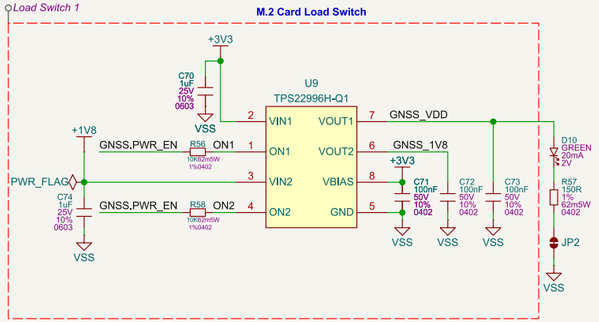


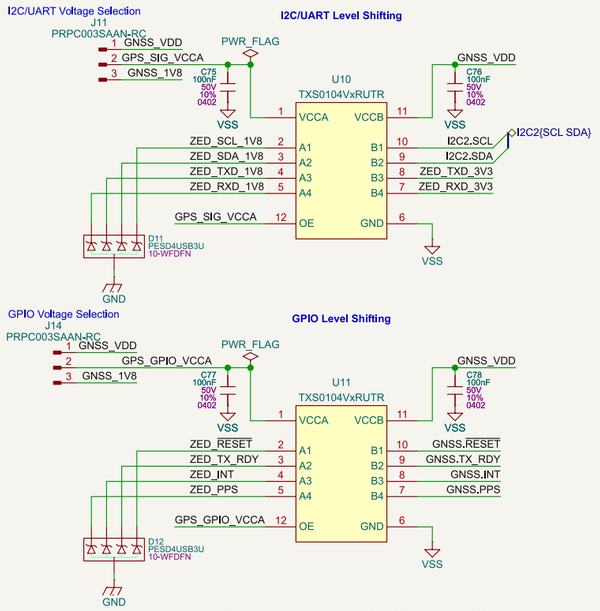










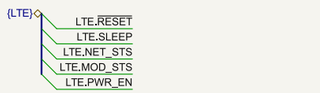


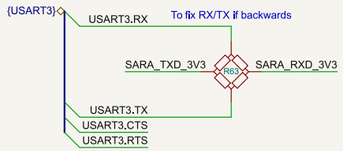
Status PROTOTYPE

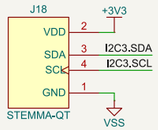
Embry-Riddle Aeronautical University

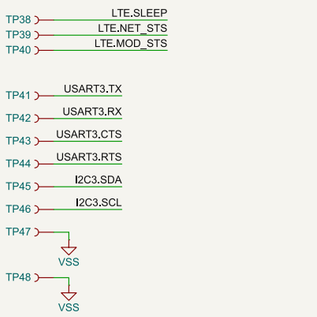
Title: Awohali - GNSS M.2 Card

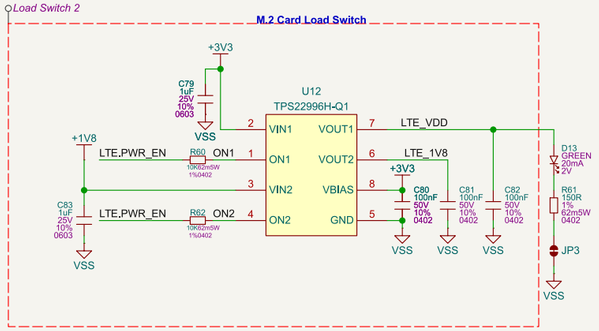
Size	Sheet: /GNSS Card/	Revision: 1
B		
Date: 2025-05-13		Sheet 8 of 16
File: gnss.kicad_sch		Drawn By: Madison Gleydura

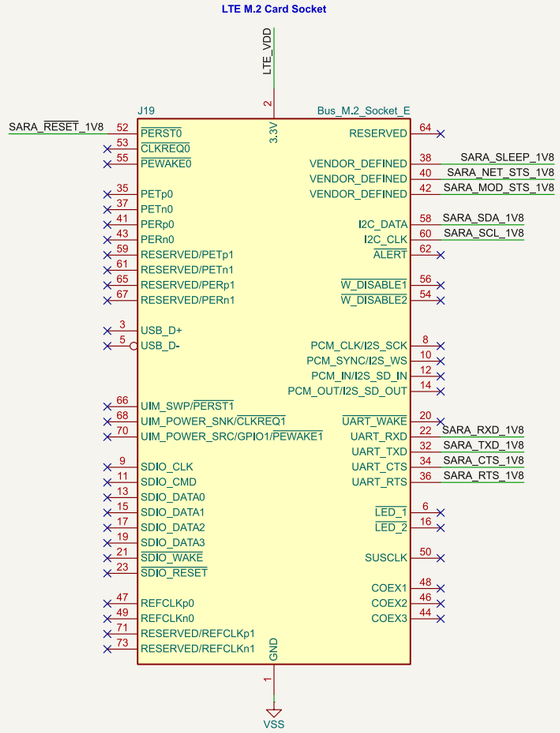


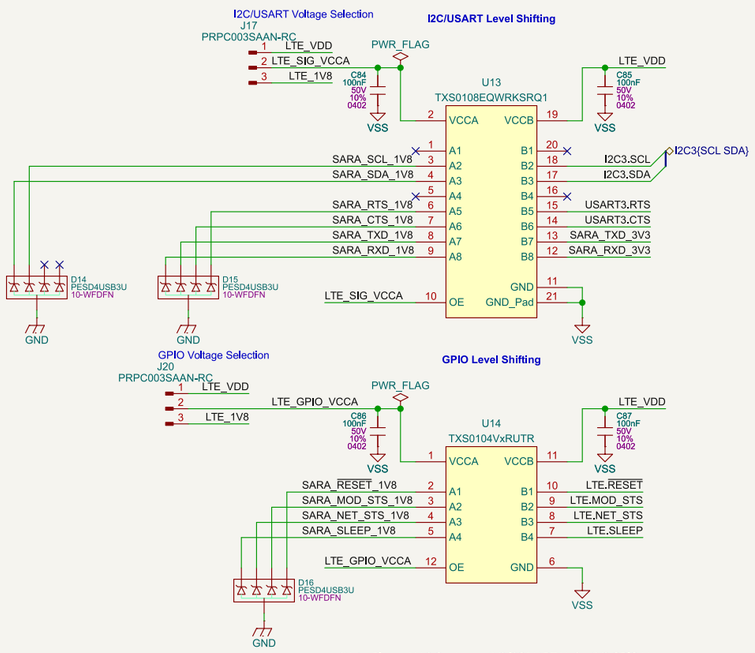


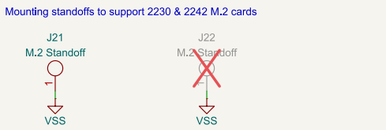










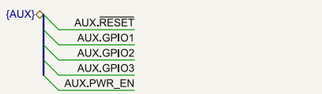


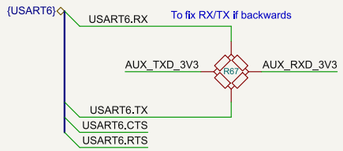
Status PROTOTYPE

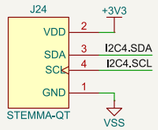
Embry-Riddle Aeronautical University

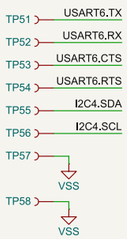
Title: Awohali - LTE M.2 Card

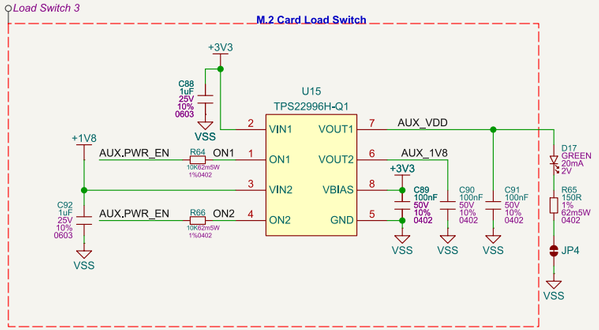
Size	Sheet: /LTE Card/	Revision: 1
B		
Date: 2025-05-13		Sheet 9 of 16
File: lte.kicad_sch		Drawn By: Madison Gleydura

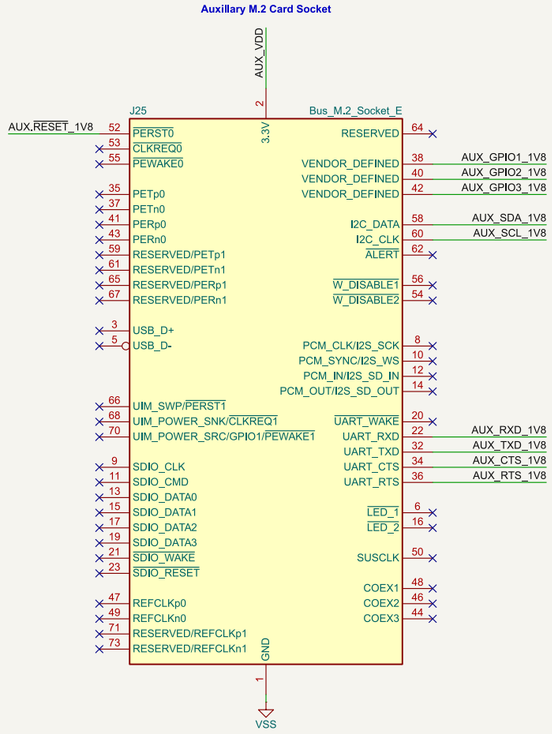


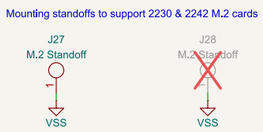


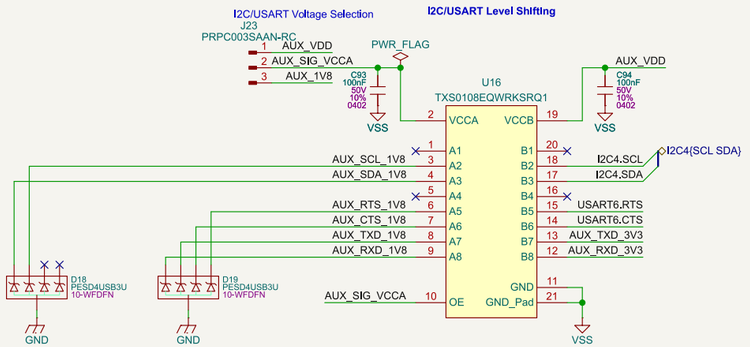


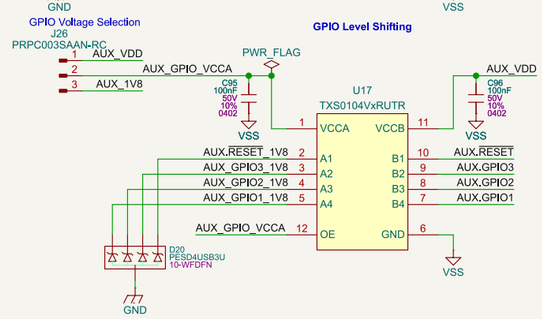












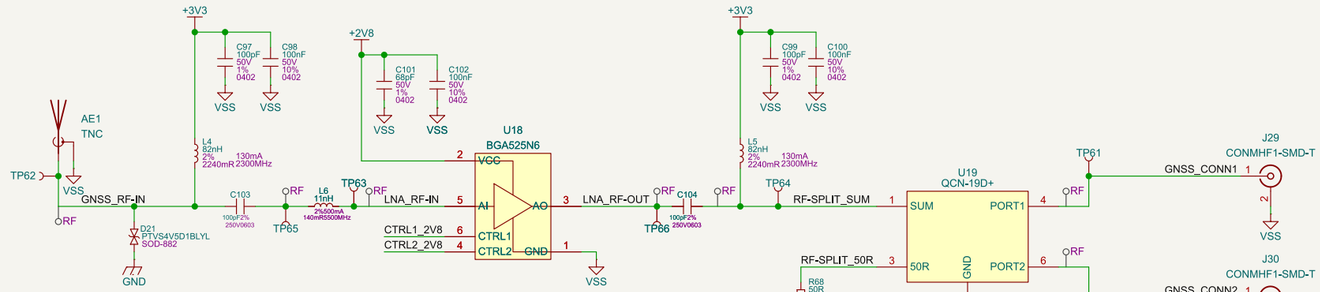
Embry-Riddle Aeronautical University

Title: Awohali - Auxillary M.2 Card

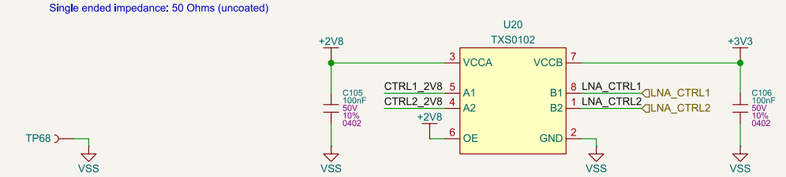
Size	Sheet: /Auxiliary Card/	Revision: 1
B		

Date: 2025-05-13	Sheet 10 of 16
File: auxillary.kicad_sch	Drawn By: Madison Gleydura

GNSS Card Cable



Single ended impedance: 50 Ohms (uncoated)



LNA + RF Splitter for duel GNSS cards sharing tri-band antenna

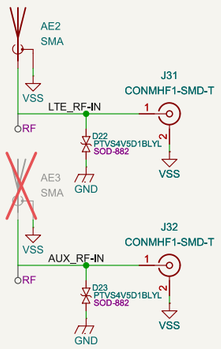
GNSS L Bands
Lower L-Band: 1164MHz - 1300MHz
Upper L-Band: 1559MHz - 1610MHz

Gain Mode Selection Table

V_CTRL1	V_CTRL2	Gain Mode
Low	High	High Gain Mode
High	Low	Standard Mode
High	High	Low Power Mode
Low	Low	OFF Mode

LTE Card Cable

AUX Card Cable



SMA/TNC to u.FI to allow for full integration testing outside enclosure.
Panel mount RF connectors w/ soldered u.FI cable would require rear panel mounted for testing :(

Status PROTOTYPE

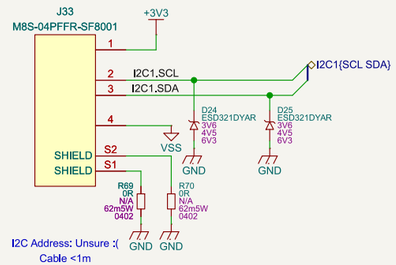
Embry-Riddle Aeronautical University

Title: Awohali - RF Interface

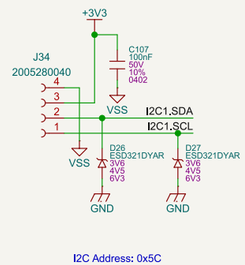
Size	Sheet	Revision
B	Sheet: /RF Interface/	Revision: 1

Date: 2025-05-13	Sheet 11 of 16
File: rfInterface.kicad_sch	Drawn By: Madison Gleydura

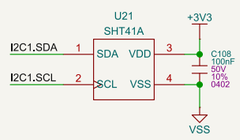
External Temperature/Humidity Sensor



Internal Pressure Sensor w/ port



I2C Address: 0x5C



Status PROTOTYPE

Embry-Riddle Aeronautical University

Title: Awohali - Environmental Sensors

Size	Sheet: /Environmental Sensors/	Revision: 1
Date: 2025-05-13		Sheet 12 of 16
File: sensors.kicad_sch		Drawn By: Madison Gleydura

{SPI1}
SPI1.MOSI
SPI1.MISO
SPI1.SCK
SPI1.SS_H7
SPI1.SS_L4
SPI1.GRANT
SPI1.REQ

EPS Controller

STM32H7 Boot/RESET for reboot DFU for this uC

U22A
STM32L433CCU6

CAN_STB 10 PA0
SPI1.SCK 11 SPI1_SCK
BAT_CHG_INT 12 PA2
EPS_EEPROM_WC 13 PA3
SPI1.SS_H7 14 SPI1_SS
BOOT0_H7 15 PA5
SPI1.MISO 16 SPI1_MISO
SPI1.MOSI 17 SPI1_MOSI
SPI1.SS_L4 29 PA8
EPS.SCL 30 I2C1_SCL
EPS.SDA 31 I2C1_SDA
L4_USB.DN 32 USB_DM
L4_USB.DP 33 USB_DP
L4_SWDIO 34 SWDIO
L4_SWCLK 37 SWCLK
PG_2V8 38 PA15
32768Hz 2 PC13
32768Hz 3 OSC32_IN
4 OSC32_OUT
NEOPIXEL_DIN 5 PH0
LED_BUILTIN 6 PH1

PB0 18 PG_1V8
PB1 19 EN_1V8
PB2 20 EN_2V8
PB3 39 RESET_H7_L4
PB4 40
PB5 41 HUB_L4_INT
PB6 42 HUB_L4_INT
PB7 43
CAN1_RX 45 L4_CAN_RX
CAN1_TX 46 L4_CAN_TX
PB10 21 PG_3V3
PB11 22 BAL_ALERT
PB12 25 SPI1.GRANT
PB13 26 SPI1.REQ
PB14 27 QON
PB15 28 CE
RESET 7 RESET_L0
BOOT0 44 BOOT0_L4

RESET_H7

Pull high to reset H7

Q2 BSS138-7-F 50V 200mA 5V5 3R5

CAN for inter-microcontroller communication

SW3 PTS810
SW4 PTS810
D28 S2SSD6R3.3ST52W3 4V87V8
C109 100nF10% 50V0402
C110 100nF10% 50V0402
R74 10K 1% 62m5W 0402
R75 10K 1% 62m5W 0402

D29 LTST-C19KRKT 2V20mA
R73 100R62m5W 5%0402
R71 4K7 1% 62m5W 0402
R72 4K7 1% 62m5W 0402

Battery Charger
QON
CE
BAT_CHG_INT
TS
EPS{SCL SDA}
File: batteryCharger.kicad_sch

Battery Manager
BAL_ALERT
TS
EPS{SCL SDA}
File: batteryManager.kicad_sch

Voltage Regulators
EN_2V8
EN_1V8
PG_3V3
PG_2V8
PG_1V8
File: voltageRegulators.kicad_sch

NeoPixel VDD != 5V b/c testing shows that +3V3 works okay

D30 IN-PI15TAT R76 100R62m5W 5%0402

U22B
STM32L433CCU6

VDDA 9
VBAT 1
VDD_USB 36
VDD 24
VDD 48
VSSA 8
VSS 23
VSS 35
VSS 47
GND_PAD 49

VDDA/VSSA connected to +3V3/VSS b/c not used

C111 4,7uF 16V 10% 0805
C112 1uF 25V 10% 0603
C113 1uF 25V 10% 0603
C114 1uF 25V 10% 0603
C115 100nF 50V 10% 0402
C116 100nF 50V 10% 0402
C117 100nF 50V 10% 0402
C118 100nF 50V 10% 0402

Capacitor Placement:

VBAT	1uF
VDD	4,7uF, 3x 100nF
VDDA	1uF, 100nF
VDDUSB	1uF, 100nF

EEPROM for EPS Config Settings

512kB I2C EEPROM

U23
M24512-DRE
C119 100nF 50V 10% 0402
EPS_EEPROM_WC
EPS.SCL
EPS.SDA

I2C Addresses
Memory Page: 0x50
Identification Page: 0x58

Pull WC low to write to memory array

J35 STEMMA-QT
J36 Tag-Connect Socket

TP69 EPS.SCL
TP70 EPS.SDA
TP71
TP72
TP73

Status PROTOTYPE
Embry-Riddle Aeronautical University

Title: Awohali - EPS Controller

Size	Sheet: /EPS Controller/	Revision: 1
B		
Date: 2025-05-13		Sheet 13 of 16
File: epsController.kicad_sch		Drawn By: Madison Gleydura

Pv Panel Jack
VIN: 12V
Current Limit: 8A (4A per pin)

J37
M8S-04PFFR-SF8001

D31 PTVS13VS1UR 13V 14V4 21V5
C120 100nF 50V 10% 0402
R78 0R N/A 62m5W 0402
R79 0R N/A 62m5W 0402
R77 294R 1% 62m5W 0402

Battery Charger

Q3 CSD17581Q3A 30V21A 1V73m8R
Q4 CSD17581Q3A 30V21A 1V73m8R
Q5 CSD17581Q3A 30V21A 1V73m8R
Q6 CSD17581Q3A 30V21A 1V73m8R
D32 BZT52C12T-7 12V 900mV 300mW
D33 BZT52C12T-7 12V 900mV 300mW
C121 10uF 25V 10% 1210
C122 10uF 25V 10% 1210
C123 100nF 50V 10% 0402
R81 294R62m5W 1%0402

U24 BQ25798
VBUS, VCHG, ACDRV1, ACDRV2, VAC1, VAC2, D+, D-, BTST1, SW1, SW2, BTST2, STAT, CE, QON, EPS_SCL, EPS_SDA, PMID, PROG, ILIM_HZ, SYS, BAT, SDRV, BATP, TS, REGN, INT, BAT_CHG_INT, PVIN, GND

C134 47nF 25V 10% 0402
L7 2.2uH 20% 7A8 16m6R 40MHz
C137 47nF 25V 10% 0402
C124 100nF 50V 10% 0402
C125 10uF 25V 10% 1210
C126 10uF 25V 10% 1210
C127 10uF 25V 10% 1210
C128 100nF 50V 10% 0402
C129 10uF 25V 10% 1210
C130 10uF 25V 10% 1210
C131 10uF 25V 10% 1210
C132 10uF 25V 10% 1210
C133 10uF 25V 10% 1210
C135 10uF 25V 10% 1210
C136 10uF 25V 10% 1210
C138 47nF 10% 25V 0402
C139 4.7uF 10% 16V 0805
R86 100K 62m5W 5% 0402
R87 2K26Ω 1%0402
R88 10K 1% 62m5W 0402
D34 LTST-C191KGKT 20mA 2V
JP5

Program Resistor
R80 6K20 1%0402

Charge status LED
Charge enable
Ship Mode control
Pull $\overline{QON}$ low to activate shutdown mode
Charge Enable: Pull $\overline{CE}$ LOW
Charge Disable: Pull $\overline{CE}$ HIGH
I2C Address: 0x6B

Ship Mode for optional extended power saving by disconnecting battery. Used for testing and servicing.

Current Limitor

R82 47K 1% 62m5W 0402
R84 100K 1% 62m5W 0402
R83 9K1 1% 62m5W 0402
R85 29K4 1% 62m5W 0402
J38 S2B-PH-SM4-TB
Thermistor Connector 10K NTC

TP74 VBUS
TP75
TP76 VSYS
TP77 VCHG
TP78 PVIN
TP79 CHG-

Switching Frequency		
Mode Selection	Program Resistor	Inductor Value
2S @ 750kHz	8K2	2.2uH
2S @ 1500kHz	6K04	1uH
3S @ 750kHz	13K7	2.2uH
3S @ 1500kHz	10K5	1uH

V_ILIM_HZ = 1V + 800mR * I_INDPM
I_INDPM (target input current) = 3A
V_ILIM_HZ = 3400mV

R1 = R2(5000mV - 3400mV)/3400mV
R2 = 100K
R1 ~= 47K

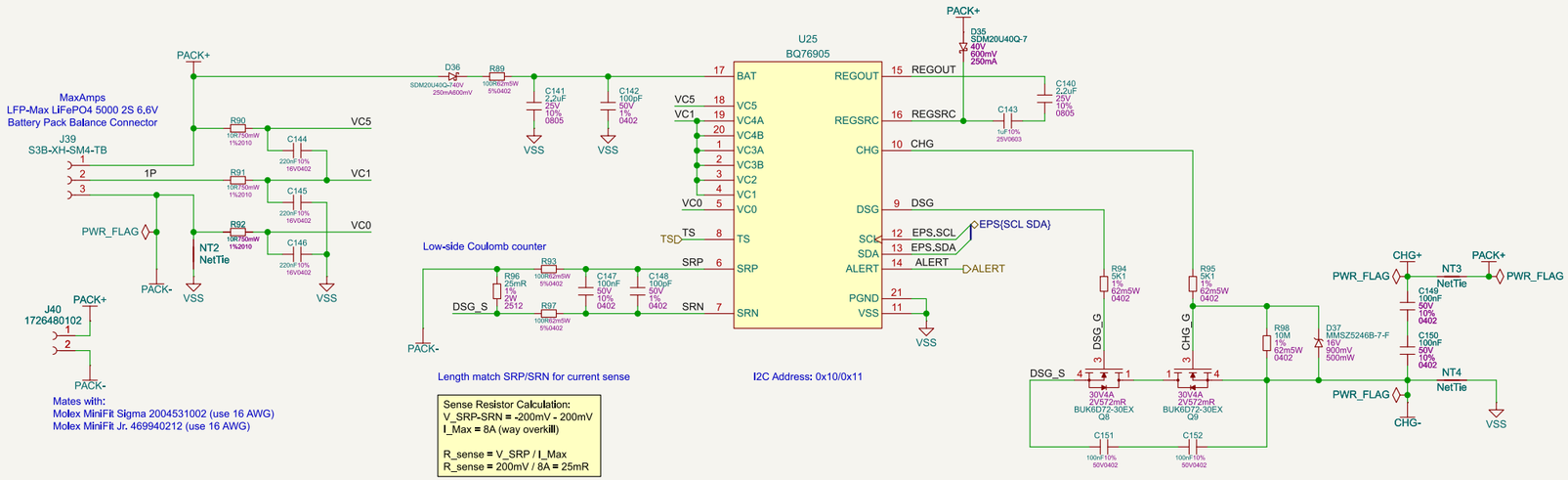
RT2 = (RTH_COLD * RTH_HOT * (1/VT1 - 1/VT5)) / (RTH_HOT * (1/VT5 - 1) - RTH_COLD * (1/VT1 - 1))
RT1 = (1/VT1 - 1) / (1/RT2 + 1/RTH_COLD)

Status PROTOTYPE
Embry-Riddle Aeronautical University

Title: Awohali - Battery Charger

Size	Sheet	Revision
B	Sheet: /EPS Controller/Battery Charger/	Revision: 1
Date: 2025-05-13		Sheet 14 of 16
File: batteryCharger.kicad_sch		Drawn By: Madison Gleydura

Battery Balancer and Protector



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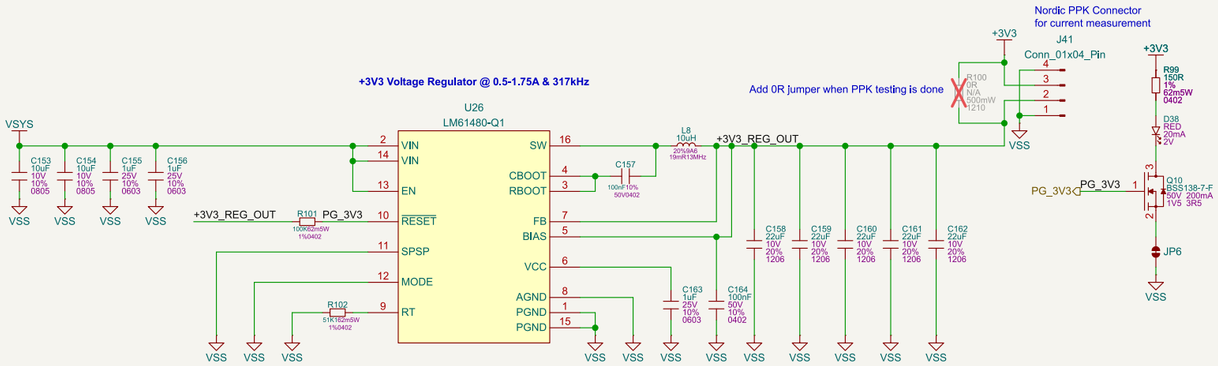
Title: Awohali Battery Monitor and Protector

Size	Sheet	Revision
B	/EPS Controller/Battery Manager/	1

Date: 2025-05-13	Sheet 15 of 16
File: batteryManager.kicad_sch	Drawn By: Madison Gleydura



Status PROTOTYPE

Embry-Riddle Aeronautical University

Title: Awohali - Voltage Regulators

Size	Sheet: /EPS Controller/Voltage Regulators/	Revision: 1
B	Date: 2025-05-13	Sheet 16 of 16
	File: voltageRegulators.kicad_sch	Drawn By: Madison Gleydura